June 5, 1894.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President,
in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of May:—

The registered additions to the Society's Menagerie during the month of May were 112 in number. Of these 54 were acquired by presentation, 28 by purchase, 2 by exchange, 8 were born in the Gardens, and 20 were received on deposit. The total number of departures during the same period, by death and removals, was 99.

Mr. Sclater offered some remarks on the animals he had noticed in the Zoological Gardens of Rotterdam, Amsterdam, Hanover, Berlin, and Hamburg, which he had recently visited.

At Rotterdam the Jackdaws had effected an entrance through the wide meshes of the net that covered the large Aviary, and had somewhat disturbed the breeding birds. But the colony of Wild Herons outside (*cf.* P. Z. S. 1892, p. 471) was still thriving, and consisted of 28 nests. Amongst the Mammals at Rotterdam one of the greatest interest was a beautiful male example of the Bush-loving Antelope (*Cephalophus sylvicultrix*) from Congo-land (*cf.* P. Z. S. 1892, p. 471), presented by Heer A. de Bloema on the 25th May, 1891, now quite adult, and of about 2 ft. 8 in. high. Mr. Sclater exhibited a water-colour drawing by Mr. Keulemans representing this animal.

The Gardens of the Royal Zoological Society of Amsterdam were in their usual flourishing condition, the series of Cranes and Storks being, as in former years, of special excellence. The herd of the beautiful Antelope *Tragelaphus gratus* (*cf.* P. Z. S. 1892, p. 471) now consisted of seven examples, and an additional male having been imported there was every reason to hope that this fine Antelope (see P. Z. S. 1883, pl. viii.) would become thoroughly acclimatized in Europe. One of the hot-water tanks in the Reptile House contained seven living examples of the Surinam Toad (*Pipa americana*), which Mr. Sclater had never seen alive before. They appeared to keep entirely in the water, in which they swam about freely.

In the Zoological Garden of Hanover (now under the direction of Dr. Ernst Schäff) Mr. Sclater had seen several interesting Antelopes, amongst which were examples of *Hippotragus equinus*, *Bubalis caama*, and both species of Gnu. He had also obtained there for the Society specimens of both the European species of Marten, which were now rather difficult to procure.

The Zoological Garden at Berlin (now under the direction of Dr. Heck) contained an excellent series both of Mammals and Birds, and a large new Aviary was in process of erection. Here a pair of Giraffes were still to be found; and examples of the Zebra from German East Africa, lately described by Herr Matschie as *Equus boehmi*, had attracted Mr. Sclater's special attention. Amongst the Birds were noticed specimens of *Parus varius* from Japan, *Garrulax picticollis* from Formosa, of the splendid *Cotinga cincta* from South-east Brazil (now four years in the Gardens and in full adult plumage), of *Chrysotis hecki* (the type of the species), of the rare *Ara azaræ*, of both species of *Bucorax* from Africa, of several species of *Meliphagidæ* (*Entomyza cyanotis auricomis*, and *Anthochæra carunculata*), and of *Anas andamanensis*. The Eagles' Aviary contained examples of both *Haliaëtus pelagicus* and *H. brannickii*, the latter quite adult, the former just coming into full plumage.

The Hamburg Garden (under the direction of Dr. H. Bolau) presented, as usual, many attractions. Amongst the Mammals there was an example of a black Jaguar (*Felis onca*) from Santa Catarina, Brazil, also of *Felis passerum* from Argentina, and of *Viverricula schlegeli* from Madagascar. There was likewise a good series of the larger Antelopes, amongst which was a beautiful pair of the Sable Antelope (*Hippotragus niger*), accompanied by a young one now about six weeks old, and believed to be the first specimen of this species born in Europe. Amongst the Birds were noticed examples of *Polyboroides typicus*, *Musophaga violacea*, and *Struthio molybdophanes* from Somali-land, the last being quite adult, and remarkable for its blue-coloured naked skin varied by a bright red patch on the front of the tarsus and for the horny plate on the vertex.

The following papers were read:—

1. Critical Gleanings on the *Didelphyidæ* of the Serra dos Orgãos, Brazil. By Dr. Emil August Goeldi, Director of the Colonia Alpina (Theresopolis)[1].

[Received March 29, 1894.]

1. DIDELPHYS AURITA.

I have in my collection of Mammals made here in the Serra dos Orgãos, 800 m. above sea-level, nine specimens of a *Didelphys*, evidently all belonging to the same species or variety, although they show some slight differences in size, colour, and fur. Of all of them I possess both skin and skull; one specimen is stuffed and mounted. Seven are adult, while two are rather less than half-grown, as they have still their milk-dentition in place.

How shall I call the animal? If I should guide myself merely by the exposition given by the most modern monographer of the Marsupials—Mr. Oldfield Thomas[2]—this question would be very quickly decided. This author admits only one living species of the subgenus *Didelphys*—*D. marsupialis*—with two varieties: *D. marsupialis typica*, very widely spread over the American continent and including even *D. virginiana* and *D. californica* of other zoologists, with a range extending to Chili and Brazil; *D. marsupialis* var. *azaræ*, on the other hand, being confined to the countries bordering the Amazonian Basin, but ranging on the eastern coast to South Brazil. The characters are purely external and may be briefly referred to as follows:—Face without, or with indistinctly defined, black and white markings—var. *typica*; face with sharply defined black and white markings—var. *azaræ*. In the list given of the specimens contained at that date in the collection of the British Museum from Brazilian localities I find four of var. *typica* (3 from "Brazil," 1 from "Rio de Janeiro") and two of var. *azaræ* (both from Taquara, Rio Grande do Sul, collected by my friend and colleague Dr. H. von Ihering).

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[1] Communicated by Dr. A. Günther, F.R.S., V.P.Z.S.

[2] 'Catalogue of the Marsupialia and Monotremata in the Collection of the British Museum' (London, 1888), p. 315.

Well, according to the exposition of Mr. Oldfield Thomas, there is absolutely no doubt that I should have to determine my specimens from the Serra dos Orgãos as belonging to *D. marsupialis* var. *typica*.

To anybody who has occupied himself seriously with the study of Marsupials, it is evident that the family Didelphyidæ in general, and the genus *Didelphys* in particular, is, even in our days, what is called a "crux zoologica." On this point Mr. Oldfield Thomas says:—"With the exception of the short-tailed Opossums the series available for examination in the European museums seems to be fairly complete, but in the case of these more specimens are urgently needed before the species can be at all satisfactorily worked out and the present arrangement of that, the most difficult, group must be looked upon as merely tentative in its nature." And some lines above he writes:—"The systematic arrangement of the Opossums has formed the subject of an unusually large number of memoirs, of which the best have been written by Temminck, Waterhouse, and Burmeister. These and all other authors appear, however, to have erred in the admission of by far too great a number of species, formed on the most trivial characters of colour and size, and therefore a large reduction has been found to be necessary in the present work."

I perfectly agree with Mr. Thomas as to the great difficulty presented by the group, and I even partly share his opinion that the number of species admitted by former authors is too large and that the synonymy has been much overburdened. But when he chooses the radical method of cutting the Gordian knot by condensing all the species into one and grouping all older synonyms around two varieties only, it seems to me that he goes too far.

On reviewing the writings of the three principal authors who have discussed the Mammals of this region—Burmeister[1] [2],

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[1] 'Systematische Uebersicht der Thiere Brasiliens, welche während einer Reise durch die Provinzen von Rio de Janeiro und Minas Geraes gesammelt oder beobachtet wurden,' vol. i. (1854).

[2] 'Erläuterungen zur Fauna Brasiliens,' Berlin, 1856.

Winge[1] [2], and Hensel[3]—it appears that, however many recognizable forms of the subgenus *Didelphys* there may ultimately be, all the Opossums obtained by myself in the Orgãos Mountains are exclusively *D. aurita*, whether this be itself reckoned as "species" or "variety." This is distinctly the animal so well represented by Burmeister, plate iii. of his 'Erläuterungen.' And the determination becomes certain from the cranial views (Burmeister, pl. v. fig. 3, pl. vi. fig. 1) and the osteological details given by Hensel (figs. 3, 6). Evidently it was not one single character, but a complexity of features, which engaged Winge not to drop *D. albiventris* as a remarkable and constant Campos-variety of *D. marsupialis.* The same complexity of features occurs to me in regard to *D. aurita* of the forest coast-region of Rio de Janeiro[4]; and I may now add that during a stay of more than ten years in this province, in the hot and low zones, as well as in the mountains of the Serra dos Orgãos, I have always met with exactly the same form among the hundreds of specimens I had occasion to see.

Some of the specimens in my collection agree exactly with Burmeister's plate iii., showing the same general reddish-brown colour of fur, with longer whitish or greyish piles on the whole back or at least on the posterior part. Others are more or less blackish, with longer piles or bristle-hairs of the same colour, the points of these piles being split, as a rule, into many branches, especially on the dorsal median line, and appearing dirty white. No correlation with age, sex, or season could be discovered in regard to the presence or absence of the whitish piles, and I made exactly the same observation referred to by Hensel (p. 112). I took notes about the last twelve specimens I saw: seven of them had white bristle-hairs intermixed, while five were more or less blackish. Of these seven specimens four were adult males, one a young male, one an old female, and one a half-grown female. They were collected in August 1891, April 1892, February 1893, May 1893, and three in December 1893. The five blackish specimens were caught in October 1892, February, March, July, and August 1893, and three of them were males (old, medium, and young); two were females, both half-grown[5]. The face-markings are on the limit between distinct and indistinct, and I consider this circumstance as a good external character for a rapid discernment of *D. aurita.* Only in one case—a young female—were these face-markings very distinct, as yellowish longitudinal stripes.

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[1] 'Jordfundene og unlevende Pungdyr (Marsupialia) fra Lagoa Santa, Minas Geraes, Brasiliens,' Kjöbenhavn, 1893.

[2] Lagoa Santa. Et Bidrag til den biologiske Plantegeografi af Egnens Värming,' Kjöbenhavn, 1892. (Lagoa Santa Egnens Hvirveldyr.)

[3] "Beiträge zur Kenntniss der Säugethiere Süd-Brasiliens," Abhand. d. königl. Akad. d. Wissensch. Berlin, 1892.

[4] It can be seen by Pelzeln's 'Brasilische Säugethiere' (Wien, 1883), p. 109 *et seq.*, that Natterer also determined all his specimens of large *Didelphys*, collected in the neighbourhood of Rio de Janeiro and the coast-region, as belonging to *D. aurita.* About six specimens collected in Sapitiba (district of Rio de Janeiro) Natterer noted on the label a sign of question, but Pelzeln adds the words:—"Dürfte wohl zu *D. aurita* zu rechnen sein, während die echte *D. cancrivora* dem Norden Süd-Amerikas angehört." It is to be regretted that Pelzeln's work on Natterer's Brazilian Mammals is not provided with good illustrations, especially of the smaller Didelphyidæ and Rodents.

[5] Hensel states that among 57 individuals of *D. azaræ* he noted 11 black

All the figures I know of *D. cancrivora* represent this animal with very indistinct face-markings (compare Burmeister, pl. iv.); and on the other hand the authors always draw *D. azaræ* and *D. albiventris* with most conspicuous face-markings (*cf.* Burmeister, pls. i., ii.). In regard to the colour of the ears, I repeat what I said in my little work on the Mammals of Brazil[1], that *D. aurita* and *D. cancrivora* have uniformly dark-brown coloured ears, and, so far as concerns the first, I had full occasion to make this statement on the living animal.

Dentition.—Much has been written about the dentition of *Didelphys*, and the literature has been thoroughly co-ordinated by Mr. H. Winge, 'Pungdyr,' p. 113 and p. 122 *et seq.* For the present I have no mind to write at all fully on this matter and I will restrict myself to the remark that abnormalities are so rare that I have never yet seen a single skull of an adult *D. aurita* with a formula other than strictly $\frac{5.1.3.4}{4.1.3.4}$. This contrasts somewhat with some of our Brazilian carnivorous animals; the Tayras (*Galictis*), for example, often show some symmetrical abnormalities in the number of molars.

2. METACHIRUS QUICA.

Of the subgenus *Metachirus*, established by Burmeister in 1856, no other form was observed by me in the Serra dos Orgãos than the common "Quica" (*Didelphys opossum*, Linn., of Thomas), which is frequently seen in the forest as well as in the neighbourhood of Tazendas. In snares destined especially for Rodents I constantly found this beautiful but stupid and incautious marsupial. My collection contains about a dozen individuals from this locality. There is great uniformity in the general colour: all show the same clear glistening grey above and a yellowish belly. I never met with a female of the reddish tone indicated by Burmeister, pl. viii.[2] I may mention here that some years ago I took an

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ones (6 ♂, 5 ♀) and 45 white ones (22 ♂, 23 ♀), and that among 9 young individuals, still contained in the mother's pouch, he observed one black, two mixed, and six white ones. This observation, together with my own above cited (young male and half-grown female), proves that Burmeister is wrong when he denies the existence of young *Didelphys* with white bristle-hairs with the words:—"Kein junges Thier hat weisse Grannen" (Erläut. p. 58).

[1] E. A. Goeldi, 'Os mammiferos do Brazil.' Rio de Janeiro (Alves e Cie.), 1893. Monographias brazileiras, vol. i.

[2] I confess that I was doubtful as to the existence of such reddish "Quicas" until recently. Almost at the moment of posting these notes, my family in Rio de Janeiro gave me on my return from Colonia Alpina a great surprise by a present of a nice young *male* "Quica," very well corresponding to Burmeister's figure. Its eyes are also reddish brown (cherry-colour), somewhat like those of an albino, and its tail is throughout, but especially on the basal

adult "Quica" from Brazil safely to Switzerland, feeding it on board the steamer mainly on fruits. The individual was presented to the Basel Zoological Garden.

3. Micoureus griseus.

My collection contains a single specimen of a fine grey *Micoureus*, somewhat doubtful as regards the species. The dimensions of the dry skin are:—length of body 120 mm., tail 155 mm.; the basilar length of the skull is 32 mm. The colour of the fur (which is notably soft and velvety, much more than in *Metachirus quica*) is greyish above, with a rufous tone on the shoulders and more bluish in the region of the legs; pure white on the underside. Distinct blackish face-markings surround the eyes and run forward to the neighbourhood of the nose. There is no white spot above the eye as in the "Quica." The tail is furry at its basal part for about 1 cm., and becomes suddenly naked and scaly on the remainder; its colour is uniformly greyish, and does not show the contrast of black and fleshy, so apparent on the tail of a young "Quica."

The number of grey species of Didelphyidæ is small, embracing (besides *M. quica*) *Didelphys cinerea*, *D. grisea*, *D. velutina*, and *D. elegans*. *D. cinerea*, which I know principally from the figure given by Burmeister, pl. xii., and the description of Mr. O. Thomas (p. 342 *et seq.*), is larger and presents other differences. *D. velutina* (Burmeister, pl. xiv.) differs, as we know by Natterer's type in the Vienna Museum, in having a tail inferior in length to the body, and shows (if Burmeister's figure is approximately correct) a pale circular eye-marking, not running forward to the nose. For some time I believed my animal to be *D. elegans*, and I was brought to this idea by Burmeister's pl. xv., showing a small marsupial very similar to my specimen, and even now I do not consider the question satisfactorily settled.

Some doubts arose only when I obtained the work of Mr. Thomas and read his description of *D. grisea*, a species not cited by Burmeister in his 'Systematische Uebersicht' and only mentioned in a very short note in his 'Erläuterungen' (p. 83) as a form never met with by him. Mr. Thomas gives the following description:—"Fur close, soft, and rather fluffy. General colour above uniform deep grey, with scarcely a tinge of rufous. Face rather pale grey; the dark eye-markings confined to the front of the eye and comparatively inconspicuous. Ears very large, leafy. Chin, chest, and belly pure sharply-defined white, the line of demarcation, especially on the neck, with a slight rufous or fulvous wash. Pouch absent[1]. Tail long, slender, tapering, its basal half-inch furry, the remainder practically naked; grey above, white below." The characters here

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part, irregularly spotted with pale dark marks of different size. The face-markings are as yet very indistinct. The bright bluish tinge of the scrotum, which is comparatively very large as a rule in Didelphyidæ, is also very noticeable. (24/2/94.)

[1] My specimen is a male, therefore I am in doubt about the pouch.

given, together with the measurements, agree tolerably well with those presented by my specimen. The basal length of the skull of an adult individual is equally mentioned as being 32 mm.; and as "habitat" Mr. Thomas gives "Central and Eastern Brazil." The individuals in the British Museum are from "Rio de Janeiro."

On the other hand, *D. elegans* is said to be a Chilian form. Mr. Thomas indicates as its habitat "South Brazil and Chili," but in the list of the British Museum individuals of *D. elegans* I cannot discover any Brazilian locality.

4. MICOUREUS PUSILLUS. (*Grymæomys agilis.*)

A second member of the subgenus *Micoureus*, frequently observed by me here in the Serra dos Orgãos, is *M. pusillus*, almost impossible to be confounded with any other little *Didelphys*, except perhaps *D. lepida*, recently described from the Amazons. Its bright rufous fur, its very dark and conspicuous eye-markings, and strongly-developed "vibrissæ" readily distinguish this most graceful and really very beautiful "pygmy Opossum." Burmeister's figure on plate xv. is not entirely satisfactory, as the rufous general colour is not sufficiently marked.

Mr. O. Thomas says (p. 354) about the smaller Didelphyidæ, especially of the subgenus *Peramys*: "The habits of the species are as yet undescribed, but they are probably far less arboreal than the other Opossums." I think this observation is applicable also to the smaller forms of the *Micoureus*-group; and as I have had considerable opportunities of observing the habits of these animals, both in freedom and in captivity, it may be of interest to relate some of the most peculiar features.

Everybody acquainted with the European Dormouse (*Muscardinus avellanarius*) will easily gain an idea of *Micoureus pusillus*. In spite of the different orders they belong to, the likeness of the two animals is a most striking one as regards the size, the fur-colour, the movements, and the confident demeanour.

Micoureus pusillus is often brought to me by our workmen when occupied in new "rocas." Persons not knowing about the common Brazilian system of agriculture, may learn that a wise law obliges the owner to clear of forest a certain space around the homestead, the trees being afterwards burnt when dried by the sun ("derubada"). The continued line of accumulated sweepings (dry leaves and branches) formed by this process is called "aceiro." I found that these "aceiros," especially when running in the neighbourhood of some watershed, are a favourite resort of our marsupial.

During the day it will rarely be seen, and only some accident will oblige it to leave its hiding-place, but only for an instant until it has again found a refuge. Such an accident is the fire, when the dry "derubada" is kindled. When made prisoner it does not oppose much resistance nor bite severely. Placed in a hollow tube of bamboo, it bears easily a journey of several hours.

Several times I had specimens of *Micoureus pusillus* of both sexes alive for some time in my study. In order to obtain certainty about the feeding in freedom, the most natural way was to examine the excrements of fresh captured specimens. These I always found to be composed principally of hard remnants of insects and small Arthropoda—elytra of beetles, legs and scales of butterflies, and wings of flies. Having at my disposal a flourishing brood of meal-worms (*Tenebrio molitor*), which I had obtained from Europe as a convenient food for the numerous birds, reptiles, and batrachians which I have always around me for daily observations of their habits, generally most insufficiently known, it was not very difficult to accustom these marsupials to take the worms. Soon they became very fond of meal-worms and ran to meet the offering hand or pincers. The prey seized, they sit up like a squirrel and so many rodents, and, holding the insect with the hands (opposing sometimes only the first finger, sometimes the first two to the remainder), they crush it rapidly with visible eagerness and audible smacking. This aspect of the graceful animal always reminds me of the European Dormouse. The eyes, like black resplendent pearls, give to the physiognomy of the face an expression particularly confident. All the movements are sudden, rapid, and executed with elegance. The animal is fond of water and milk, and will not delay long when these liquids are offered in a spoon. It drinks often and continuously, lapping like a dog or a cat, and water seems to be a most important article with it. During the day it likes to sleep in some hiding-place, formed by leaves, cotton, or tow; but the sleep is not very deep, and short diurnal excursions in its cage are frequently observed. It seems to be most susceptible to cold and moisture. Towards the evening the little marsupial becomes more and more lively and agile, and during the night it is more or less in constant movement. There is thus no doubt that its habits are by preference nocturnal, and it is easily comprehensible why these animals are comparatively seldom met with during the day, except by the accidents above mentioned. Nearly all of my prisoners of *Micoureus pusillus* succeeded in finally escaping during the night; one was observed for nearly a fortnight after his escape in my study, without any possibility of discovering his hiding-place during the day. He plundered my caterpillars and chrysalids on his nocturnal depredations.

The gait of *Micoureus pusillus* is somewhat different from that of a rodent of equal size. It is a trot, generally not so rapid as that of a house-mouse. When sleeping the tail is rolled up; in movement it is extended in a straight line. I have sufficient proofs that *Micoureus pusillus* is not entirely unable to climb, but I am sure that in general it lives principally on the ground and that it has to be considered as very little arboreal.

5. PERAMYS TRISTRIATUS.

With certainty I can distinguish only one member of the subgenus *Peramys* among the material of Didelphyidæ collected in the Serra dos Orgãos. I identify it with the *P. tristriatus*

(*Hemiurus*, *Microdelphys*) of most authors, and may say that this species is here almost more frequent than *Micoureus pusillus*.

Mr. O. Thomas (*l. c.* p. 363 *et seq.*) admits two species of three-lined *Peramys*—a larger (*P. americanus*) and a smaller (*P. iheringii*), giving a good figure of the latter on plate iv.

The habitat of *P. americanus* is mentioned as "Brazil" (type not in existence), and that of *P. iheringii* as "South-Brazil," especially Rio Grande do Sul (type in British Museum). Mr. Thomas says of *P. iheringii*:—"This species appears externally to be merely a dwarf form of *P. americanus*, but it may always be distinguished not only by its much smaller size, but by the different shape of the skull, and especially by the marked flattening of the frontal region."

I confess my scepticism about the opinion of Mr. Thomas, and I think I have serious reasons to do so. Concerning the measurements this author states that he follows Burmeister, "Erlaüt." p. 84, giving the dimensions of the same individual. But Burmeister writes:—whole length 7″ (that is 7 Prussian inches), tail 2″ 2‴ (2 Prussian inches 2 lines). The Prussian inch is 2·6154 cm., and the dimensions are equal therefore to 183 mm. (whole length) and 57·53 mm. (tail), while Mr. Thomas reduces them to 189 mm. and 59 mm.—a perceptible difference for a small animal. The dimensions of a second individual preserved in the Berlin Museum are said to be 168 mm. (whole length) and 61 mm. (tail). On the other hand, the dimensions of the type specimen of *P. iheringii* (adult?) described by Mr. Thomas are 110 mm. (whole length) and 43 mm. (tail). So long as the minimum size of *P. americanus* and the maximum size of *P. iheringii* are not exactly determined by large series of authentic adult specimens, a definite conclusion seems to be a very difficult matter; and as the question now stands it may be allowed to interpret the difference of size as the expression of different age, the more as the shape of the skull is evidently also affected by growth, as proved by R. Hensel in his memorable investigations. I see that H. Winge shares this opinion, writing:—"*P. iheringii*, Thomas, synes at stemme ganske med smaa Individer af *Hemiurus tristriatus*" ('Pungdyr,' p. 108); and confronting the figures of skulls given by Mr. O. Thomas (Catalogue, pl. xxvii. fig. 8), H. Winge ('Pungdyr,' pl. ii. fig. 9), and Burmeister ('Erläuterungen,' pl. xi. fig. 7), I am unable to find any other essential character to warrant the admission of two different species.

I have had occasion to examine dozens of three-striped Opossums of all ages, and I can assert the existence of variations in colour and size. As regards the colour, young individuals are frequently seen with a yellowish or greyish tinge and exceedingly well-defined and conspicuous black stripes, just as in figure 2 of plate iv. of the Catalogue of Marsupials in the British Museum. Older individuals, generally more rufous, often show only pale stripes, and, not rarely, specimens will be met with apparently stripeless, the stripes only appearing against the light. I frankly confess that I have had moments when I became doubtful whether the *P. henseli*, a second new *Peramys* of South Brazil, recently described by Mr. O. Thomas, and figured on the same plate, might not also be such a pale-striped individual of *P. tristriatus*. Burmeister's figure of *P. tristriatus* (pl. xvi. fig. 2) I consider deficient in regard to several points.

Peramys tristriatus, not at all a "rare animal," as is stated by Burmeister (Syst. Ueb. p. 141), inhabits localities more or less similar to those of *Micoureus pusillus*. It is often seen in forest-paths, especially in the neighbourhood of water. When in 1891 we dug a deep channel for our sawing-engine, this channel running about a kilometre through the forest, nearly every day a *Peramys* was found in it, and even now the water often brings down some individual specimen of this marsupial. It is entirely terrestrial, and for arboreal life it is improperly built.

I also know *Peramys tristriatus* quite well as concerns its habits and character, from studying captured specimens. Its food in freedom is similar to that of *Micoureus pusillus*; but I learned that it attacks comparatively larger animals than the former, and assails without hesitation birds and mammals nearly as large as itself. I was once imprudent enough to put together in the same cage an adult *Peramys* and a young *Hesperomys squamipes*. The next morning I found nothing more of the latter than a small piece of the skin, and the cage soiled with undeniable traces of a terrible combat. The disposition of this species is not nearly so attractive as that of *Micoureus pusillus*; bloodthirstiness and a blind delight in cruelty are the prevailing features, and a low degree of intelligence renders taming a very ungrateful matter. An almost stupid restlessness and unbounded fondness for liberty, together with an unsatiable need of food, are generally the causes of a wonderfully rapid decay and death. Young individuals, however, are pleasing creatures, remarkable for their large heads. With milk and insects they can be kept alive some time by persons having the necessary time and leisure. I know here of a person who observed the copulation of *Peramys*, and was once told of a mother carrying her young on her back; unfortunately I arrived too late to see it.

It is also necessary to say that the habits of *Peramys* are equally by preference nocturnal.

The measurements of three individuals before me are:—

a. ♀ (spirit pres.) total length 157 mm., head and body 105 mm.
b. ♂ (dry skin) „ „ 179 mm. „ „ 120 mm.
c. ♂ („) „ „ 201 mm. „ „ 145 mm.

The basilar length of the skull of specimen *b* is 28·5 mm., of specimen *c* 28 mm. (Mr. O. Thomas mentions for an adult ♂ of *P. americana* 28 mm., for an adult (?)[1] ♂ of *P. iheringii* 22·2 mm.).

6. CHIRONECTES PALMATUS.

The singular and beautiful Water-Opossum, so well represented by Burmeister, plate ix., is really rare, and seems, as I mentioned in my 'Mammals of Brazil,' p. 146, to be approaching extinction. Till now I have only obtained two specimens in the Serra dos Orgãos, a male and a female, and have not had the good fortune to make any special observations on its habits in freedom.

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[1] [This query is Dr. Goeldi's, not mine.—O. T.]

Thus six species of Didelphyidæ have come under my observation during a stay of several years in Serra dos Orgãos. Mr. O. Thomas admits 24 species of this family, exclusively American, therefore we note a numeric proportion of 6 : 24, which is $\frac{1}{4}$ of the whole.

I cannot conclude these notes without calling the attention of zoologists to the necessity of cancelling a species of *Didelphys*, established on the authority of Prince Maximilian zu Wied-Neuwied at the beginning of the present century and still admitted.

Mr. O. Thomas writes (Catalogue of Marsupials in the British Museum, p. 366):—

"23. DIDELPHYS ALBOGUTTATA (White-spotted Opossum).

"Rather smaller than *D. americana*; mouse-grey, with many rows of white spots on its back. Habitat: Brazil (Forest-region). Type in the Museum of Rio de Janeiro. The above is the only information as yet published about this species, of which I have never seen a specimen."

I knew what Prince Maximilian had written about this supposed *Didelphys* (Beiträge, vol. ii. p. 412), and also Burmeister in 1854 (Syst. Ueb. vol. i. p. 340) and in 1856 (Erlaüt. p. 87); and when in 1884 I assumed the direction of the Zoological Section of the National Museum of Rio de Janeiro[1], I submitted to a thorough review the small and very imperfect series of Brazilian Didelphyidæ preserved there. I readily found the supposed *D. alboguttata*, an old specimen certainly dating from the period of Dom João VI., and soon recognized it to be a specimen of *Dasyurus viverrinus*, an Australian marsupial. Considering the intimate relations between the Portuguese colonies in Asia and South America in former times, the presence of this *Dasyurus* becomes explainable. The specimen still exists and is now properly labelled. It is one of the most droll mistakes that ever happened in zoology, and it is somewhat singular that Prince Maximilian and Burmeister, both good naturalists, showed themselves liable to make such an error. Entirely incomprehensible it is for me how Burmeister should make the matter still worse by the words:—"Das Thier lebt im Waldgebiet, und war Hrn. Bescke[2] aus eigner Ansicht bekannt, allein noch nie hatte er es, in den 20

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[1] This position I lost in 1890, as Fritz Müller and Herman von Ihering lost theirs, through the political changes in Brazil. In spite of seven years' incessant labour, I had not been able radically to reform the zoological collections and to get them out of the bad state in which I found them.

[2] A collector who resided for a long time in Novo Friburgo (Serra dos Orgãos), and whose name is often met with in the different works of German travellers and naturalists.

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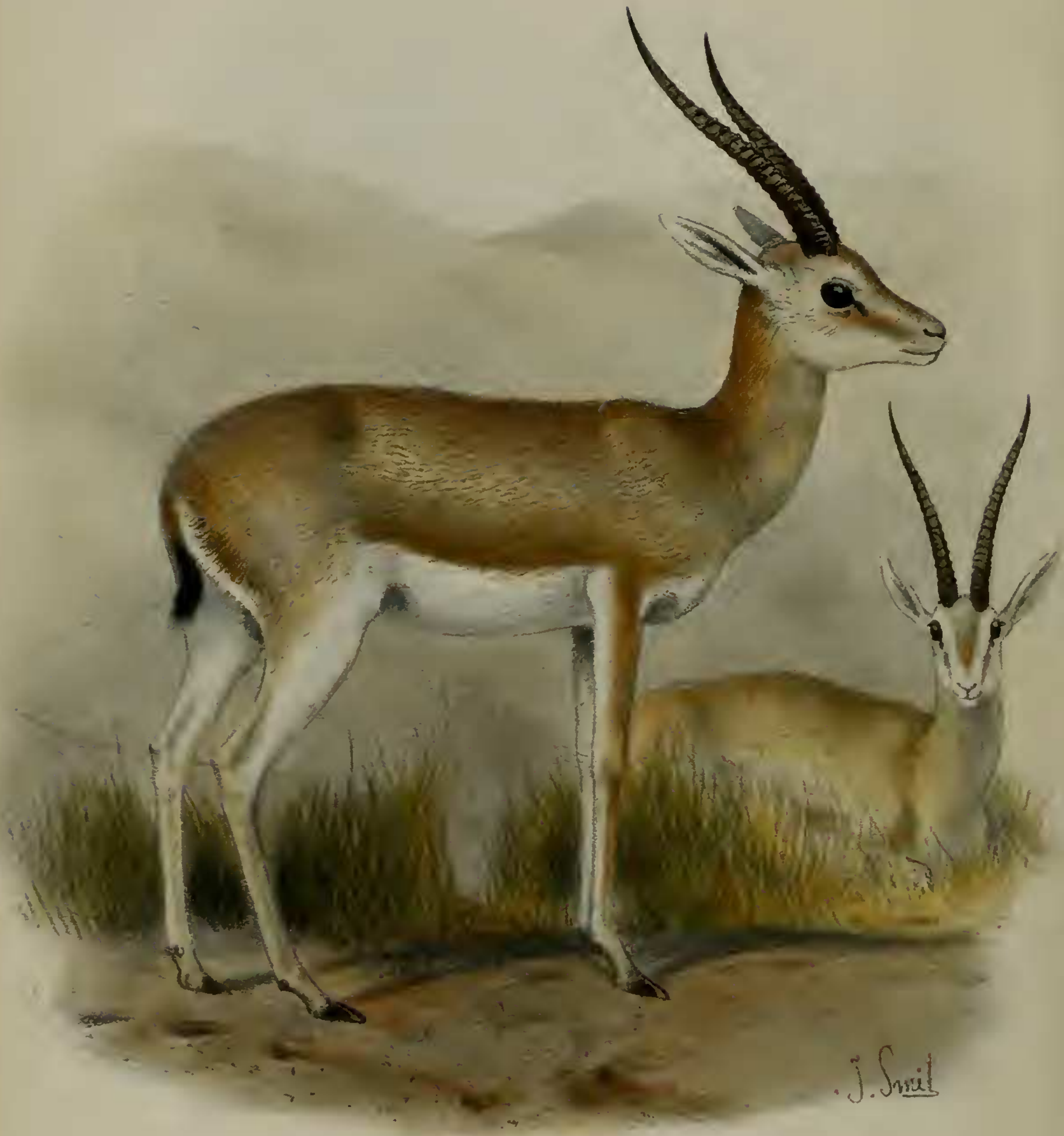


J. Smit del. et lith. Mintern Bros. imp.

GAZELLA LODERI.

Jahren seiner Anwesenheit, sich verschaffen können" (Syst. Uebers. i. p. 340).

I believed *D. alboguttata* "dead and buried," when I saw its resurrection in 1888 in the 'Catalogue of Marsupials.' I consider it my duty to give to this supposed Brazilian species of *Didelphys* eternal repose, and to deliver zoological literature from an error threatening to become hereditary from generation to generation.

2. On some Gazelles brought by Sir Edmund Loder from Algeria. By Oldfield Thomas.

[Received June 5, 1894.]

(Plate XXXII.)

By the kindness of Sir Edmund Loder I have been permitted to examine and describe some Gazelles brought by him at different times from Algeria, a country in the Natural History of which he has always taken much interest.

Of late years two Gazelles have always been recognized as natives of Algeria, namely *G. dorcas*, the Common Gazelle, and *G. cuvieri*, the Mountain Gazelle, or "Edmee." Many Gazelle-horns, however, evidently belonging to neither of these, having come into his possession, Sir Edmund undertook an expedition to obtain specimens of this unknown Gazelle, a quest in which he was fortunately successful. On his bringing back the specimens thus secured, together with another he had had some time in his possession, I was surprised to recognize no less than *four* species, two of them requiring description as new. The first of these is the Reem, an account of which is contained in the field-notes now to be read by Sir Edmund; while the other, being based on a skin purchased at Algiers many years ago, must unfortunately still remain a mystery as to exact locality until some other enterprising sportsman is able to find out where it really lives.

Sir Edmund Loder is much to be congratulated on the success of his expedition, and on the increase of our knowledge about the Gazelles which has resulted from it.

The following are the four species represented:—

1. Gazella dorcas, L.

The Common Gazelle of the Algerian Sahara generally.

2. Gazella cuvieri, Og.

A fine male specimen of the "Edmee" from the mountains north of Biskra is among Sir E. Loder's trophies. (Its skull-measurements are given on p. 472.)

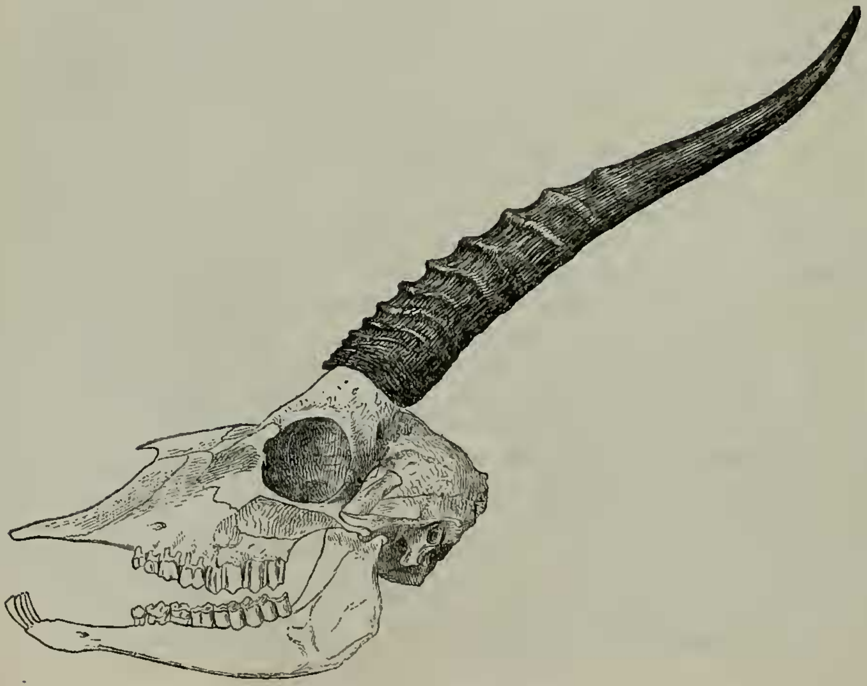
3. Gazella rufina, sp. n.

Very similar in coloration to *G. rufifrons*, Gray, but distinguished by its much larger size, heavier skull, stouter hoofs, and by the indistinctness of the light facial bands.

The general colour is a bright rich rufous, very different to the pallor of *G. loderi*. The central facial band is especially rich, almost approaching chestnut, while the light bands on each side of it, although distinguishable, are only slightly paler than the general body-colour, contrasting markedly with the white and prominent corresponding bands in other species. Crown, cheeks, and sides of neck pale rufous. Ears proportionally rather short, their exterior surfaces rufous, similar to the body in general; their edges and inner surfaces whitish. Dark lateral bands very strong and well-defined, although narrow (1 to 1½ inch broad), nearly black; light lateral bands sharply defined from the deep colour of the middle back, concolorous with the neck, cheeks, and crown. Dark pygal band but little developed. Belly white. Limbs rufous in front, whitish behind; knees without tufts, but with a narrow ridge of rufous hairs running down the metacarpus just below the knee. Hoofs large and heavy, twice the bulk of those of *G. rufifrons*. Tail rufous basally, black terminally.

Skull (fig. 1) stout and heavily built, with short broad nasals, large and widely open anterior nares, broad heavy muzzle, and large teeth.

Fig. 1.



Skull of *Gazella rufina*.

Horns unusually short in proportion to the general size, those of the type, which is unquestionably full-grown, less than once and a half the basal length, while in an equally aged *G. cuvieri* they are nearly twice that length; they are, however, very thick and strong. As to direction, they are rather far apart basally, and diverge evenly but slightly upwards; for their basal two-thirds they curve backwards, but so far less than in other species that their hinder profile is scarcely concave; their tips bend again equally slightly upwards. Of rings they have only about 10, strongly developed in front, but obsolete postero-externally.

Measurements of the type, a flat skin, probably somewhat stretched:—

Head and body (c.) 1400 mm.; tail without hairs 160, with hairs 220; ear from notch 132; fore hoof, length 54; hind hoof 54.

(Skull, see p. 472.)

Hab. Doubtful. Type bought at Algiers.

In describing this very handsome Gazelle as new the first point to be considered is its distinctness from *G. rufifrons*, Gray, the Senegal Gazelle, of which the typical specimens are in the British Museum. These specimens are two, male and female; but the male is unfortunately far younger than the type of *G. rufina*, so that the great difference in size between the two species has had to be discounted in the case of one co-type by considerations of age, and in the other of sex. But a careful comparison of a set of other Gazelles, including *G. granti*, *sœmmerringi*, *bennetti*, and *muscatensis*, has shown (1) that size does not greatly increase, however much the horns may elongate, after m^3 is up; and (2) that the sexes, widely different as the horns are, do not differ in bulk to anything approaching the extent by which the type of *G. rufina* exceeds the female co-type of *rufifrons*.

The two species, though undoubtedly closely allied, are therefore evidently separable on account of their difference in size.

Secondly, the question of *Gazella corinna*[1], Pall., has to be considered. This name was based on Buffon's "La Corine," described from a specimen which lived in the menagerie of the Duke of Orleans, and of the locality of which no mention is made[2].

Although the figure given of this animal shows undoubtedly much resemblance to *G. rufina*, the measurements, both those of the body and those of the skeleton[3], are absolutely incompatible with it, Buffon's animal, whatever it was, having been if anything smaller than *G. rufifrons*, from which, as already noted, *G. rufina* is distinguished by its considerably greater size. The true determination of the Corine is, and perhaps must always remain, impossible of solution, as Buffon's own statement that, in common with "La Gazelle" and "Le Kevel" (both undoubtedly referable to *G. dorcas*), it had knee-brushes and was of much the same size and colour as they were, conflicts with his plate, in which the artist has depicted it as without knee-brushes, bulkier in general build, and with a far better marked lateral line than in the other two. This being the case, all attempts to determine it with certainty may be abandoned as futile.

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[1] La Corine, Buff. H. N. xii. p. 261, pl. xxvii. (animal ♀) (1764). *Antilope corinna*, Pall. Misc. Zool. p. 7 (1766).

[2] Buffon's reference to the Corine of a horn brought from Senegal by Adanson must not be mistaken for a statement as to the locality of the living type specimen.

[3] An unfortunate misprint in the headline of Buffon's page 265 has given rise to some misapprehension as to the pertinence of the long table of measurements there given. Instead of "du Kevel" the line should run "de la Corine," as is clearly shown by the text of the preceding page.

It is unfortunate that for the present the exact habitat of *G. rufina* is unknown, as the skin was merely purchased in Algiers. From the richness of its colour it is not likely to be the inhabitant of an arid sandy district such as is the home of *G. loderi*, but it may come from some of the more brush-covered downs of the Sahara.

4. GAZELLA LODERI, Thos.[1] (Plate XXXII.)

Size small; form light and delicate; weight of an adult male (*teste* Loder) about 34 lb.

General colour very pale sandy or buff, the richest colour of the after-back approximately "pinkish buff" of Ridgway, and even this becomes paler and almost white anteriorly on the neck and crown, and posteriorly on the sides of the rump. Face-markings very faint, the central facial band and dark facial streaks only "buff," and contrasting but little with the ill-defined pale facial streaks. Crown nearly white, as are also the long and well-clothed ears. Light lateral bands scarcely visible, and the indistinct dark ones below them hardly as deep as Ridgway's "clay colour," as is also the case with the dark pygal band. Tail sandy at base, darkening terminally to blackish brown. Front of fore legs pale sandy buff, of hind ones whitish. Knees with short but distinct brushes. Hoofs very peculiar, and evidently specialized for progress over light yielding sand. They are much elongated, very narrow, and produced above into a sharp knife-edge; the angle at which their plane of wear lies shows that they are habitually widely divergent in life, as might indeed be expected.

Skull (fig. 2) of about the size and proportions of that of *G. bennetti*, but rather lighter and more delicate.

Horns very slender, close together at base, widely divergent above, their tips from 8 to 10 inches apart in well-marked examples. Viewed from the side they are seen to curve slightly but evenly backwards for four-fifths of their length, while their slender tips are slightly recurved upwards, but there is nothing to call a terminal hook; their annulations are well defined and rather near together, amounting in number to 20 or more, the most out of a large number of horns being 27 in a particularly fine and graceful pair belonging to Sir E. Loder.

Measurements of the type, an adult male skin, with perfect skull:—

Length of body (approximate) 900 mm.; ear from notch 130;

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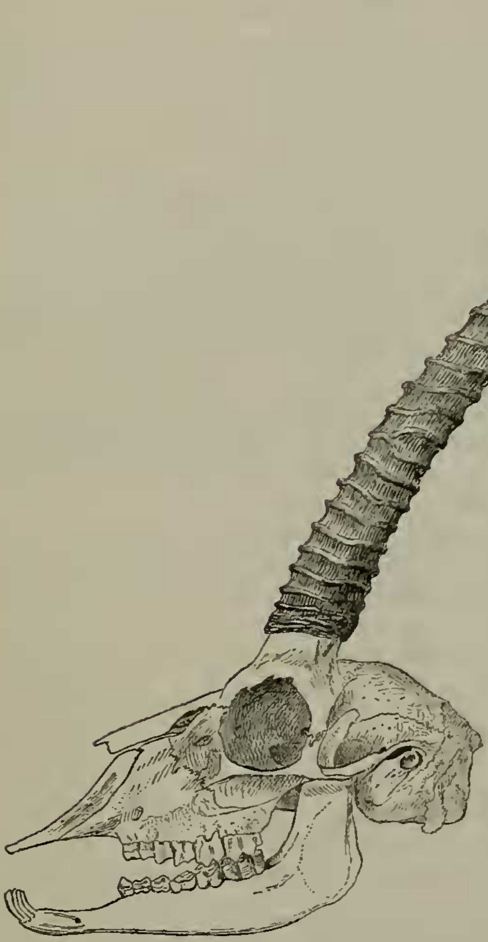
[1] Ann. Mag. N. H. (6) xiii. p. 452 (1894).

hind-foot, without hoof (c.) 280; length of fore hoof 64, of hind ones 56; tail without hairs, 90.

(Skull, see p. 472.)

Fig. 2.



Skull of *Gazella loderi.*

Hab. Sand-dunes of Oued Souf, about 100 miles south of Biskra. (See field-notes by Sir E. Loder, p. 473.)

This remarkable little Gazelle is readily distinguishable from all other species by its pallid colour, semi-obsolete markings, slender divergent horns, and long narrow hoofs.

Its habitat, as may be seen by the field-notes of its collector, is somewhat inaccessible, and it is therefore the less surprising that examples fit for description have not previously fallen into the hands of naturalists. Its horns have, however, long been purchasable at Biskra, and the first I had seen were bought there by Mr. Rowland Ward, and submitted to me for examination about two years ago, but the horn characters were too little marked for the species to be described merely on the specimens I then saw.

Loche, in his work on the Mammals of Algeria, speaks of a Gazelle known to the Arabs as "el Rim," the name now used by them for *G. loderi*, and no doubt the same species was intended. His reference runs as follows:—"Les Arabes distinguent encore sous les noms de *el Rim* et *el Chergui* deux autres Gazelles que nous n'avons pas jusqu'ici eu occasion d'examiner, et qui pourraient être des métis des espèces précédentes"[1]. This sentence was quoted by Lataste in 1885[2], but he had no information of his own to add to it.

It has therefore been reserved for Sir E. Loder to clear up the history of this interesting Gazelle, so long known by reputation, but until now an unsolved mystery to the scientific world. As his expedition into the desert was undertaken expressly to obtain the Reem, and thereby settle a doubtful problem, it is only right that the species should bear his name, which I have therefore had great pleasure in attaching to it.

Whether the companion problem of "el Chergui" is equally solved by Sir E. Loder's specimen of *G. rufina* above described is a point which can be settled only when we know the exact locality and Arab name of the latter.

Skull-measurements (in millimetres) of the Algerian Gazelles referred to.
(All adult males.)

	Gazella dorcas.	*G. cuvieri.*	*G. rufina.*	*G. loderi.*
Greatest length	170	210	—	194
Basal length	158	187	(c.)204	173
Greatest breadth	78	92	93	85
Anterior nares, length (gnathion to nasal tip)	50	60	69	54
Anterior nares, greatest breadth	20	25	30	24
Nasals, length	44	65	52	57
Nasals, breadth	19	27	34	24
Gnathion to orbit	85	113	124	101
Palate, length	83	111	120	98
Gnathion to alveolus of front premolar	37	51	59	44
Length of molar series	55	60	66	55
Horns—length round curves in front	303[3]	348	292	330
Basal circumference	99[3]	108	119	95
Least distance of horns apart at base	16[3]	105	22	14
Breadth across outside bases of two horns	70[3]	73	86	65
Tip to tip	112[3]	110	141	192

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[1] Expl. Alg., Mamm. p. 69 (1867).

[2] Mamm. Barb. p. 174 (1885) (Act. Linn. Soc. Bord. xxxix.).

[3] In another finer specimen, whose basal length is about 5 mm. longer than in that measured.

3. On the "Reem" Antelope of Algeria[1]. By Sir Edmund Giles Loder, Bart., F.Z.S.

[Received June 1, 1894.]

Seventeen years ago (in 1877) I bought in the bazaar at Biskra several pairs of Gazelle horns. They obviously belonged to three species: *Gazella dorcas*, called by the Arabs "Rezal"; *Gazella cuvieri*, which they call "Admi"; and a third called "Reem," which I was not able to identify with any described species. All these horns were on frontal bones only. It is very rarely that the Arabs bring in any whole skulls or skins for sale, and I have never seen anything but frontlets of the "Reem."

In 1891 and again in 1893 I went out to Algeria for the purpose of hunting Mouflon (*Ovis tragelaphus*).

In 1877 I had been prevented from going after them except for a few hours at a time. On these later trips I was more successful and secured some fine male Mouflon, a female of the large Mountain Gazelle (*Gazella cuvieri*), and a few specimens of *Gazella dorcas*.

At Biskra I again found horns of the Reem, but got no information about it except that it was reported to live in the sand. I heard a French name for it for the first time, "Gazelle des Sables."

As my friend Mr. Alfred Pease was spending a second winter at Biskra and had made the acquaintance of several native hunters, I requested him to try what he could do to find out the habitat of the Reem. About Christmas-time last year he wrote to me that he believed he had reliable information that the Reem was to be found in the desert near Chegga, only about 50 kilometres south of Biskra on the caravan-route to Touggourt.

We made arrangements for a camping trip, and I left England on February 1st, and started from Biskra with Mr. and Mrs. Alfred Pease on February 8th of this year.

After two days' marching we got to Chegga and made inquiries respecting the Reem. No one seemed to know anything about the animal except one Arab, who said that if we went on farther south we should come to a place called Ain Gebberah, where there were a few Reem, but if we went on still farther to Hamraia we should find the Reem in quantities.

We therefore travelled on for two or three more days until we came to Hamraia, but on making inquiries about the Reem the answers were very unsatisfactory. We determined, however, before giving up the search, to stay here a day to hunt and see what game there was in this part of the desert.

In the early morning of the next day Pease started off from camp with an Arab in one direction, while I went off in the other. By the evening we had covered a considerable extent of country and had used our glasses from every available rise in the ground. We saw several small herds of *Gazella dorcas*, but no tracks even of any other Gazelle. We did not seem to be any nearer to obtaining a Reem than when we started from Biskra.

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[1] Gazella loderi, Thomas, above, p. 470.—Ed.]

At night, when we got back to camp, we were told that a negro camel-herd had been there during the day, and had said that we were not at all in the right country for Reem, that he was well acquainted with the animal and knew where it was to be found. He came into camp again the next morning and told us that the Reem had long slender hoofs and tender feet, lived only in the soft sand, and would be unable to run on hard stony desert such as that round Hamraia. He said he could take us to the Reem country, in rolling sand-hills, but we should not be able to camp very near as there was no water for our horses and pack-animals.

We agreed to go with him, and he led us a day's march still farther south towards the Oued Souf, and then turned off the caravan-track to the east and chose a camp in the sand about an hour and a half from water. (Almost all the water in the desert is brackish and bad, but the water we got here was positively nasty.)

The next morning we left camp very early on horseback, with the negro on foot and an Arab hunter riding a mule. The negro led the way at a tremendous pace, keeping up a good trot in the soft sand and sometimes running fast for a couple of miles without a stop across the dry arm of a chott, keeping us at a hand-gallop most of the time.

After two hours and a half the negro pointed out the first track of the Reem, which is quite easily to be distinguished from that of *Gazella dorcas* from its much greater length. We now unsaddled the horses, tied them up, and went off in two parties to hunt for Reem. The negro led the way in front of me, going slowly and with great caution, as the Reem is extremely wary and against the nearly white sand can detect a moving object a long way off. We had not walked very far when we saw the head of a Reem looking over the top of a sand-ridge at about 300 yards distance. We stayed for a long time perfectly still behind a tuft of tall alpha grass, till at last the head disappeared. As soon as it was out of sight we ran as hard as we could across the bare sand to the top of the next ridge, and again sheltered ourselves behind a tuft of alpha. When we looked out cautiously we saw that the Reem had moved on to another sand-hill more to our left, and was again showing just the top of his head over it. We had, however, considerably reduced the distance. Again he stopped perfectly still for a long time and then turned and moved off. We ran to another ridge, and I caught sight of him trotting to the top of the sand-hill beyond at about 150 yards. At the top he turned and I fired at once and got him. A lucky shot! as the distance was long for so small an animal. It was a good male, with horns 13 inches long. I have not seen any much longer than these.

After taking the Reem back to the place where we had left the horses, we started off again, and during the day saw several small lots containing both males and females (4, 5, and 2), but did not get a chance of another shot. Pease also saw a few.

We hunted the sand-hills for two more days; on the third day our negro guide took us much farther from camp, running before us with surprising speed and endurance for three and a half hours before we halted and tied up our horses. In the evening, after walking all day in a hot sun and on soft sand, he showed himself still untired and ready to run at the same pace back again to camp. This remarkable man said that he had lived for seven years in the desert without sleeping in a house or tent, and had hardly tasted water, meat, or bread; during the whole of that time his food consisted of dates and camel's milk, and he attributed his strength to this diet. The long distance of our camp from the sand-hills where the Reem is found was a great hindrance, as we could not hunt for them at the time they were feeding. By the time we got to the ground they were already lying down for the day, generally on the top of the sand-ridges, and keeping a watchful look-out. We saw several small herds each day, but neither of us ever got another chance of a shot.

We were lucky in having calm weather, as a sand-storm in that country is a very serious matter. The air gets as thick as during a bad London fog and one cannot see even a few yards ahead, making it quite impossible to regain camp, all tracks being blotted out in a few minutes by the wind. Our experience of sand-storms was limited to *one* day, our last day in the desert, luckily for us well outside the region of the sand-hills, when leaving our caravan behind we rode in 50 kilometres to Biskra in the teeth of a cutting wind filled with dust and sand, an extremely painful experience; but we were in no danger of losing our way as we were then on the broad track worn by the caravans travelling between Biskra and Touggourt.

The Reem is remarkable for its light and uniform coloration, the ordinary Gazelle-markings being hardly noticeable. The long slender hoofs are also very peculiar, reminding one of those of *Tragelaphus spekii*, which lives in the swamps on the borders of lakes and rivers.

It is quite certain that the Reem can never drink, as there is no water in this country at all, except in the comparatively deep wells dug by the natives.

The following measurements of the male Reem were taken directly after it was killed:—Height at shoulder 2 ft. 4 in.; girth at brisket 2 ft. 1 in.; length of horns 13 in. It weighed, after being brought into camp (without entrails), 34 lb. These are about the measurements and weight of *Gazella dorcas*.

For comparison I give the measurements of a good male *Gazella cuvieri* which I killed in the mountains a few weeks after the Reem: Height at shoulder 2 ft. 7 in.; girth at withers 2 ft. 8½ in.; weight without entrails 58 lb.

As to the distribution of these species, I may say that *Gazella cuvieri* is found entirely in the mountains, never down in the true desert. It climbs like a Chamois to the tops of the highest mountains in the rockiest ground, and is often found in the juniper-forests on the mountain-slopes. These are also the haunts of the Mouflon, the two animals being constantly seen on the same ground.

Gazella dorcas is found all over the hard stony desert and also on the foot-hills, so that it sometimes overlaps the range of the Admi. I have seen a few in the sand-hills, the true country of the Reem; but I believe that still farther south it is not found, its place being taken entirely by the Reem. I quite believe the statement of the natives that the Reem is never found off the soft sand.

4. Note on the Period of Gestation of the Indian Antelope, *Antilope cervicapra* (Linn.). By Sir Edmund Giles Loder, Bart., F.Z.S.

[Received June 1, 1894.]

Well known as is the Indian Antelope, the period of its gestation does not seem to have yet been ascertained. Blanford, in his 'Fauna of British India,' 1888–91, quotes Elliot, "The rutting-season commences about February or March, but fawns are seen of all ages at every season;" and adds a note of his own, "I cannot find the period of gestation recorded." Jerdon, in his 'Mammals of India,' 1874, gives the same quotation from Elliot. Sterndale, 'Natural History of the Mammalia of India,' 1884, copies this quotation but not quite correctly:—"The *breeding*-season begins in the spring, but fawns of all ages may be seen at any time of the year."

Having kept a herd of these Antelopes for several years, practically in a wild state, in a park of considerable extent, I should like to take this opportunity of putting on record my own observations.

I find that the does of this species breed *regularly* here twice every year. One particular doe, which is tamer than the others, and therefore perfectly well known, had a young one on April 10, 1892, and another young one on November 10 of the same year.

It is usually very difficult, if not impossible, to tell the *exact* date of the birth of a fawn, as the does hide their young ones very closely in the heather and bracken for a fortnight or three weeks, visiting them only during the night.

When the young ones are first seen with the herd they are probably three weeks to a month old.

Another doe had a young one on May 7, 1893, and a second on October 14, 1893. The period of gestation must therefore be about 5 months.

5. Notes on a particularly Abnormal Vertebral Column of the Bull-frog; and on certain other Variations in the Anuran Column. By W. Blaxland Benham, D.Sc. (Lond.), Hon. M.A. (Oxon.), Aldrichian Demonstrator in Comp. Anat. in the University of Oxford.

[Received April 4, 1894.]

(Plate XXXIII.)

Among the skeletons of *Rana mugiens* which are kept in spirit and used for class purposes at Oxford I came across one specimen which exhibited certain striking abnormalities. Like the rest of the vertebral columns this had not been entirely macerated, so that the vertebræ were still connected by connective tissue; and as the outlines of the vertebræ were not well defined, the specimen looked at a first glance merely slightly curved—the curvature being more marked on the ventral than on the dorsal surface.

I have had drawings made of this column, natural size, viewed from below and from above. (See Plate XXXIII.)

There are the normal number of transverse processes on each side, viz. eight, but it will be noticed how curiously these eight are distributed. There are only six separate vertebral pieces (A, B, C, D, E, F), three of them being "compound vertebræ" and showing more or less distinct signs of their fusion. The first "piece" consists of the normal "atlas" fused with the second vertebra, which possesses the usual pair of transverse processes. The second piece (B) consists of $2\frac{1}{2}$ vertebræ; on the right side it carries two transverse processes, on the left three. The next two vertebral pieces appear to be perfectly normal vertebræ, each with a pair of transverse processes, and, as far as can be judged, they are symmetrical.

The fifth vertebral piece (E) consists of $1\frac{1}{2}$ vertebræ, and bears two transverse processes on the right side, and only one on the left—thus it is the complement of the second piece.

The last, or ninth, vertebra is normal and articulates with a normal urostyle.

The separate vertebral pieces, which present abnormalities, are drawn the natural size; but their side views are represented twice the natural size.

The first piece (A), figs. 3–6, consisting of "atlas" and second vertebra, is asymmetrical; the fusion is greater on the right than on the left side, for on the latter there is a large intervertebral foramen, just in front of the transverse process, whilst on the right side there is an extremely small perforation through which even a very fine needle will not pass, and it is scarcely likely that the "hypoglossal" nerve could issue here. On this side, however, the neural arch of the "atlas" is less extensive than on the left; and it is possible that the first spinal nerve, instead of issuing between the vertebræ, passed in front of the arch, for there is a well-marked notch (*x*, fig. 6) between it and the facet for the occipital condyle. The dorsal limit of the neural arch of the "atlas" is fairly distinct, except on the right side; elsewhere the hinder margin overlaps the anterior margin of the second vertebra in the usual way, but synostosis of the zygapophyses and arches has taken place: there is no hole between them.

The centra, too, are entirely anchylosed, but the line of fusion is very distinct, and, as Howes has noted[1], is marked out by a prominence or ridge. This line of fusion is not symmetrical, as the drawing shows.

The second vertebral piece (B) (figs. 7–11) possesses three neural spines (*a*, *b*, *c*), but is composed of only two vertebræ on the right side, each with a transverse process (III.′, IV.′); whilst on the left there are distinctly three vertebræ represented by three transverse processes (III., IV., V.).

If this compound piece be viewed from below (fig. 8), certain faint lines are seen crossing the compound centrum in oblique directions: they are not by any means distinct, and result rather from differences in structure than from any ridge; but they indicate the planes of fusion and suggest that this piece consists of the normal 3rd vertebra (III.), followed by a semi-vertebra (IV.) on the left side, and this again by a complete vertebra (IV.′, V.). This suggestion seems to receive a certain amount of confirmation from the fact that the compound centrum is curved, the concavity being towards the right. This interpretation acquires further justification from the fact that there is a half neural arch with its spine (*b*) separating, on the left side, the more normally constituted arches. The first of these is, however, distorted, the neural spine (*a*) being directed distinctly towards the left side; the anterior zygapophyses are asymmetrical, and other evidences suggest strong compression of the arch, resulting in a forward thrusting of the left half of the arch (III.) by the extra half vertebra (IV.).

The hinder region of this compound piece is symmetrical. Here, as before, the fusion between the arches dorsally is complete, but laterally the intervertebral foramina exist—a small one on the right side (fig. 10), just admitting an ordinary needle; two larger ones on the left (fig. 9).

The transverse processes are curiously unsymmetrical (figs. 7, 8, 11). The first on the left side (III.), the strongest, is bent downwards; the third (V.) on this side is directed nearly straight outwards as in the normal Frog; whilst on the right side the first transverse process (III.′) is quite short and ends in an irregular fashion; the second (IV.′) is long, and appears to correspond in size with that of the fourth vertebra in a normal column, and, like it, is curved upwards. The corresponding transverse process of the left side (IV.) is smaller and irregular; whilst that marked V. is directed upward and agrees with that carried by a normal fifth vertebra.

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[1] Howes, "Notes on the Variation and Development of the Vertebral and Limb-skeleton of the Amphibia," Proc. Zool. Soc. 1893, p. 268.

The next two pieces (C, D) appear to be entirely normal vertebræ, and separated from the rest would undoubtedly be regarded as such.

The third compound piece (E) (see figs. 12–15) consists of the normal eighth vertebra, with an extra half neural arch and transverse process on the right side (VII.'). Ventrally, the centrum is only slightly unsymmetrical, being a little longer on the right than on the left side. There is no sign or mark of an extra centrum. But dorsally there is evidence, in the existence of two neural spines (*d*, *e*), together with a deep groove halfway along the right arch, as well as in the presence of two transverse processes, of fusion of an extra half vertebra (VII.').

There is an intervertebral foramen between the two transverse processes of the right side: of the latter the anterior (VII.') is directed straight out; the posterior (VIII.') is flattened, and its distal extremity curves upwards, in a manner only slightly different from the normal.

I have used the word "fusion" of vertebræ; but in the case of the second or fifth vertebral pieces I do not feel at all sure that such is the proper term to employ.

Bateson ('Materials for the Study of Variation'), in describing a somewhat analogous case of an extra half vertebra in a Python, remarks (p. 104) that the bone in question (which is closely like the 5th piece (fig. 12) of *Rana mugiens*) "is not two vertebræ simply joined together, as bones may be after inflammation or the like, but it is two vertebræ whose adjacent parts are not formed, and between which the process of division has been imperfect: with more reason it may be spoken of as one vertebra partly divided into two, but this description also scarcely recognizes the real nature of the phenomenon."

Bateson refers to one or two other similar cases in Reptiles.

But in the specimen of *Rana mugiens* we have this point of difference, that the normal *number* of vertebræ and transverse processes is retained on each side—there being, however, 9 neural spines to the first eight vertebræ. There is evidently no "intercalation" of half a vertebra; but it seems to me that during development the lines separating the mesoblastic somites were oblique instead of at right angles to the axis of the body, and that the wrong halves met across the middle line, as we find in cases of abnormal segmentation of the body in Chætopods (see Cori, Buchanan, &c.), giving rise to "spiral segments."

Thus the sclerotome destined to give rise to the right half of the fourth vertebra has united, not with its corresponding left sclerotome, but with the left sclerotome of the fifth vertebral segment. If this be the case, then the apparently symmetrical vertebral pieces C and D are not really so, but, as is indicated on the drawings, the third piece consists of $\frac{1}{2}$ V. and $\frac{1}{2}$ VI., and the fourth piece of $\frac{1}{2}$ VI. and $\frac{1}{2}$ VII.—resulting in two entire, and seemingly normal, vertebræ. But what is as curious as anything is the rectification which occurs in the fifth vertebral piece (E).

This piece, taken by itself, as we have seen, shows very little asymmetry—it is quite similar to the Python's vertebra figured by Bateson, and his description (p. 105) and explanation would equally apply here. But we see that, in the Frog, no asymmetry of the entire column results. It would, no doubt, be too laborious to count the entire number of ribs in a Python, but the suggestion may be made that the apparent "partial division" on one side (fig. 10, II., of Bateson) may be due to the same cause as I suggest above, and that it might be "rectified" further back by another half on the opposite side. He mentions, however, that the 185th vertebra of this same Python "had a similar doubling of the right side," so that, no doubt, he would have observed any corresponding doubling on the left side if it had existed.

In his paper on abnormal Frogs' vertebræ, just mentioned, Howes refers to the rarity of the "fusion" of the eighth and ninth in *R. esculenta*, so that it seems worth while to add to his specimens two others which I have met with; whereas Adolphi[1] found only one such case in 212 Toads examined, I have met with two cases in eight skeletons of *R. mugiens* (exclusive of the abnormal specimen just described). In each of these two skeletons, in fact, the conditions of the sacral and eighth vertebræ are precisely those described and figured by Howes on p. 269 (figs. 1 *a*, 1 *b*, 1 *c*), and, as there, my specimens present the slight ridge at the line of fusion. It seems, then, that *R. mugiens* presents great scope for Mr. Bateson: various kinds of "variations" occurring evidently with considerable frequency.

Having met with these instances, it seemed desirable to look over the skeletons in our Museum, so as to note any other abnormalities in the vertebral column which might be presented by them. I was rewarded by finding two cases in species of Toads. The first case occurs in a dried skeleton of *Bufo agua*, in which the "atlas" is co-ossified with the second vertebra.

The second and more remarkable case I noted in *B. pantherinus*. Here the seven anterior vertebræ are perfectly normal, but the eighth and ninth are united with one another, and the latter with the urostyle (see fig. 16, nat. size). The transverse process of the eighth is fairly stout, that of the ninth is, as usually the case in the genus *Bufo*, very considerably expanded; whereas the union of the eighth and ninth centra is indicated by "Howes' ridge," there is no indication of the junction between ninth and the urostyle, the centrum is here quite smooth. The sacral transverse process is continuous with the lateral flange or ridge of the urostyle, and there is no "coccygeal foramen" for the tenth spinal nerve, such as usually occurs, the last perforation being just behind the enlarged transverse process.

Similar instances of fusion of the ninth vertebra with the urostyle

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[1] Adolphi, Morph. Jahrb. xix. p. 320.

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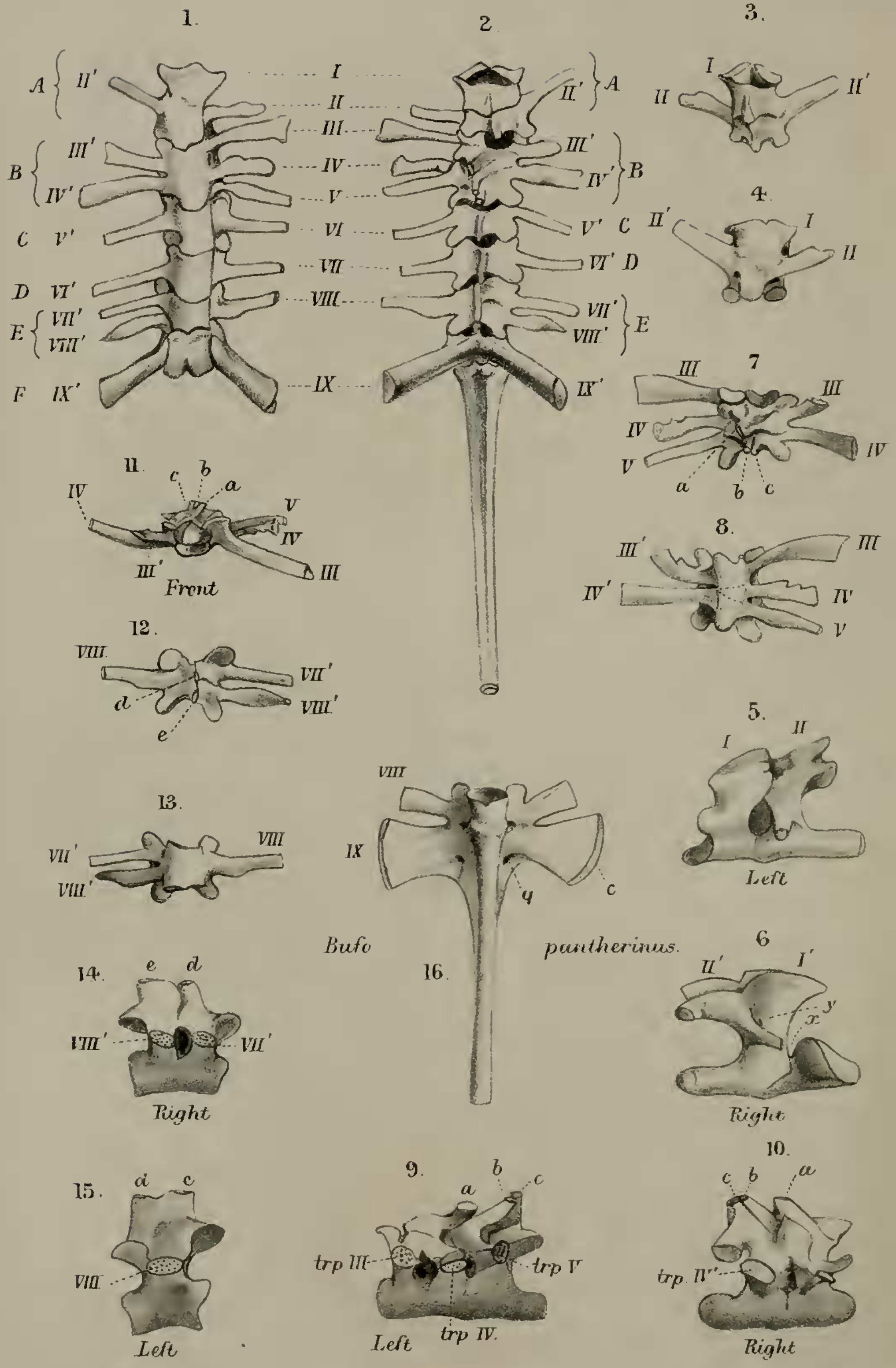

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ABNORMAL VERTEBRAL COLUMN OF RANA MUGIENS